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Covid-19 Pandemic

Low prevalence (0.13%) of COVID-19 infection in asymptomatic pre-operative/pre-procedure patients at a large, academic medical center informs approaches to perioperative care



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ABSTRACT

Background: The coronavirus disease 2019 (COVID-19) pandemic has resulted in reduced performance of elective surgeries and procedures at medical centers across the United States. Awareness of the prevalence of asymptomatic disease is critical for guiding safe approaches to operative/procedural services. As COVID-19 polymerase chain reaction (PCR) testing has been limited largely to symptomatic patients, health care workers, or to those in communal care centers, data regarding asymptomatic viral disease carriage are limited.

Methods: In this retrospective observational case series evaluating UCLA Health patients enrolled in pre-operative/pre-procedure protocol COVID-19 reverse transcriptase (RT)–PCR testing between April 7, 2020 and May 21, 2020, we determine the prevalence of COVID-19 infection in asymptomatic patients scheduled for surgeries and procedures.

Results: Primary outcomes include the prevalence of COVID-19 infection in this asymptomatic population. Secondary data analysis includes overall population testing results and population demographics. Eighteen of 4,751 (0.38%) patients scheduled for upcoming surgeries and high-risk procedures had abnormal (positive/inconclusive) COVID-19 RT-PCR testing results. Six of 18 patients were confirmed asymptomatic and had positive test results. Four of 18 were confirmed asymptomatic and had inconclusive results. Eight of 18 had positive results in the setting of recent symptoms or known COVID-19 infection. The prevalence of asymptomatic COVID-19 infection was 0.13%. More than 90% of patients had residential addresses within a 67-mile geographic radius of our medical center, the median age was 58, and there was equal male/female distribution.

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Conclusion: These data demonstrating low levels (0.13% prevalence) of COVID-19 infection in an asymptomatic population of patients undergoing scheduled surgeries/procedures in a large urban area have helped to inform perioperative protocols during the COVID-19 pandemic. Testing protocols like ours may prove valuable for other health systems in their approaches to safe procedural practices during COVID-19.

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Introduction

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the coronavirus responsible for the coronavirus disease 2019 (COVID-19) global pandemic, was first identified in Wuhan, China, in a cluster of cases of severe pneumonia.^{1,2} Transmission most often occurs through droplet and direct contact, though aerosol spread also occurs. Three animal coronaviruses have recently evolved to become the newest human coronaviruses. These include severe acute respiratory syndrome coronavirus (SARS-CoV), Middle East respiratory syndrome coronavirus (MERS-CoV), and SARS-CoV-2, all with the potential to cause severe disease, contagion, and resultant pandemic.³

COVID-19 is genetically closely related to SARS-CoV and has emerged as a highly contagious coronavirus with wide variability in severity of disease,² often manifesting as a simple common cold, however, potentially progressing to more serious infections like pneumonia and respiratory failure, usually in an otherwise predisposed patient with underlying health conditions. Data exist suggesting that anywhere from 5% to 75% of those with COVID-19 could be asymptomatic.⁴ While the pandemic continues to evolve, at the time of this publication, more than 18 million people have been infected globally, with over 4.8 million in the United States; over 150,000 have died in the United States, and global deaths approach 605,000.^{5,6} Lethality is approximately 3.8% globally.^{5,6}

An identified casualty of the COVID-19 global pandemic has been the cancellation or delay of what have been considered elective or nonessential procedures or surgeries.^{7,8} This disruption is a consequence of 3 operational aims: (1) to maintain low hospital census levels in anticipation of any potential COVID-19 surge, (2) to limit unnecessary patient and health care worker (HCW) SARS-CoV-2 exposures, and (3) to reduce consumption of limited supplies including stocks of personal protective equipment (PPE).

Recent data suggest an increase in perioperative respiratory complications as well as a 19% perioperative mortality rate in those with concurrent COVID-19 infection undergoing elective operative procedures.⁹ Identifying patients with active, yet asymptomatic or presymptomatic, COVID-19 infection is critical to controlling the spread of disease, to protecting HCWs, and to maximally caring for patients with COVID-19 requiring necessary surgeries/procedures. Fundamental to acquiring this information is access to widespread COVID-19 testing. To date, limitations in test availability have restricted testing largely to those with symptoms, HCWs, or those living in communal care centers. COVID-19 reverse transcriptase–polymerase chain reaction (RT-PCR) nasopharyngeal samples serve as the current gold standard to evaluate patients for COVID-19 viral infection.

Operative and interventional procedures that may result in exposure risks to HCWs must be approached cautiously, and HCWs continuing to care for patients during the COVID-19 pandemic require necessary PPE for protection against infection. There is no currently available information about degree of exposure and corresponding level of risk to surgeons, proceduralists, and anesthesiologists during operative and interventional procedures.

Limitations in the nation's supply of critical PPE (including masks able to filter bacterial and viral particles) have left health care systems considering whether to limit elective medical procedures in order to avoid exhausting this critical supply. These considerations further leave HCWs without a clear roadmap for managing care for patients requiring interventions. Approaches could range from continuing to provide care unabated for considerations of associated potential risk and availability of protective equipment, an approach that would be summarily rejected by HCWs and health system leaders, to performing no surgeries or procedures until SARS-CoV-2 has been extinguished, an equally unrealistic approach.

In an effort to inform these discussions, federal, state, and professional society guidance have been published relative to performing surgery during the COVID-19 pandemic. Early in the pandemic, the American College of Surgeons (ACS) and the Centers for Medicare and Medicaid Services proposed recommendations for limiting elective and nonessential procedures.^{7,8} Individual states weighed in with 33 issuing guidance on limiting elective surgeries.¹⁰ There has been greater focus on cancer surgeries with efforts made to balance the elective scheduling of most cancer operations with the risk of disease progression.¹¹ In a recent publication in the obstetrics and gynecology literature, Cohen et al¹² suggested that in the absence of life-threatening emergencies requiring surgery, nonoperative treatment with a delay of surgeries should be adopted.¹² Given the aerosol generating nature of airway surgery and airway management, otolaryngologists and anesthesiologists have been particularly eager to identify best practices to reduce risks of exposure.¹³ More recently, the ACS published an updated guideline addressing resumption of elective surgeries.¹⁴ Their recommendations follow several overarching considerations which include balancing regional COVID-19 epidemiologic awareness, sustaining a capable workforce and PPE supply capacity, creating clear patient communication plans addressing COVID-19 testing policies, while designing prioritization processes that adjust to institutional resources and patient needs.¹⁴ This updated ACS guidance reflects the evolving nature of the COVID-19 pandemic and supports individualized health system approaches based on local and regional COVID-19 epidemiology and health system resources and priorities.

Interpreting the meaning of elective surgery and balancing this definition with the health of the patient and protecting HCWs and PPE supply chains has proved challenging. Approaches have varied, decisions driven by procedure categories of elective, semielective, urgent, or emergency and essential versus nonessential or discretionary.^{10,15} Some health care systems have deferred to department chairpersons to identify case categories; others have deferred to health system perioperative services committee decisions. Still others have published stratification point systems or scoring algorithms that consider surgical indication, predicted resource utilization, estimated postoperative hospital length of stay, and expected requirements for prolonged ventilator use and intensive care unit level care.^{15,16} When emergency or urgent surgery has been required, algorithms for operating room precautionary measures have also been proposed.¹⁷

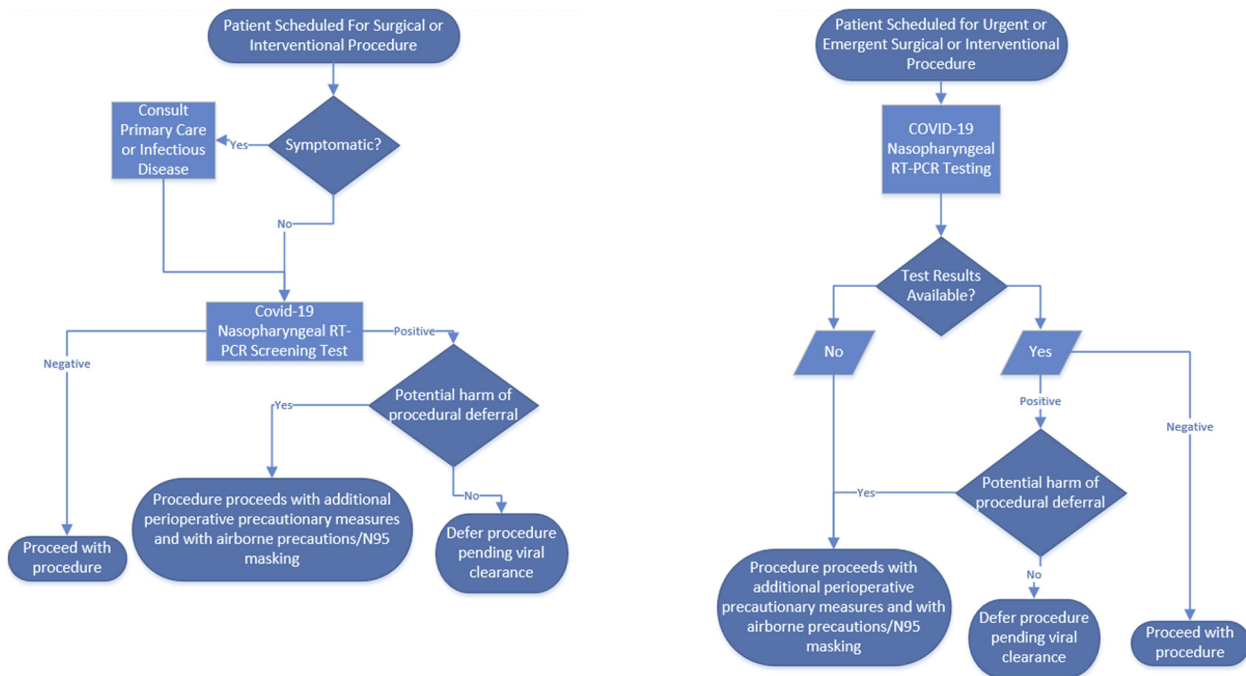


Fig 1. UCLA Health universal COVID-19 testing protocol and operative/procedural algorithms.

Scheduling and performing surgeries and procedures has been disrupted by the COVID-19 pandemic, and hospital leaders have been left with the incalculably monumental task of trying to interpret and balance state and national regulatory guidance, specialty society guidance, level of urgency in performing surgeries/procedures, and institutional resources and priorities, somehow landing on an approach to deliver necessary care to patients while protecting HCWs providing care in these settings.

In an effort to continue providing important clinical care and performing necessary surgeries and procedures early during the COVID-19 pandemic, UCLA Health adopted a protocol of screening all patients for COVID-19 symptoms with pre-operative/pre-procedure surveillance COVID-19 RT-PCR nasopharyngeal testing within 2 days of their scheduled procedure. The results of this routine screening pre-procedure/pre-operative COVID-19 testing protocol have informed our algorithms for delivering surgical/procedural care during the COVID-19 pandemic.

Materials and methods

At our health system, where we perform approximately 60,000 surgical and interventional procedures annually, a comprehensive strategy was developed and implemented to address COVID-19 pandemic-related disruptions, relying on input from surgeons, proceduralists, department chairpersons, perioperative/anesthesiology services, hospital leadership, and the infection prevention team. The UCLA Health Chief Medical and Quality Officer convened a weekly meeting with representation from these groups as well as from the UCLA Health Chief Medical Informatics Officer and surgeon-informaticists. Early during the COVID-19 pandemic, our medical center adopted Center for Disease Control and Prevention (CDC) and ACS recommendations to suspend elective surgical and interventional procedures. Starting on April 16, 2020, UCLA Health implemented universal masking of all HCWs and patients/visitors older than 2 years of age. Beginning April 7, 2020, we implemented the following protocol and algorithms for resuming elective surgical and interventional procedures. We introduced universal pre-

operative/pre-procedure COVID-19 RT-PCR testing for all patients scheduled for operative procedures requiring the presence of an anesthesiologist or interventional procedures considered high risk for potential exposure to aerosolized virus or for any patient moving through perioperative areas (pre-op/post-anesthesia care unit) where exposures to other large groups may occur. The 2-day interval was selected to allow for test results to return, to reduce potential interval exposure risk, and to reduce the interval between testing and surgery during which a prior exposure may have converted to active infection. Testing occurs 7 days a week.

Figure 1 demonstrates our protocol for universal pre-operative/pre-procedure COVID-19 RT-PCR testing and operative/procedural algorithms. Patients with symptoms of COVID-19 generally do not proceed to surgical/procedural scheduling until after consultation with, and testing directed by, primary care or infectious disease services. For asymptomatic patients with negative testing, procedures proceed as scheduled. For patients with pre-procedure testing positive for SARS-CoV-2, each surgeon or proceduralist is asked to assess potential level of harm to the patient if the procedure would be deferred. If the risk is considered low, the procedure is deferred pending viral clearance. If deferring the procedure would incur perceived harm to the patient, the procedure may proceed using additional perioperative precautionary measures and with airborne precautions using N95 respirator masks. In general, efforts are made to defer elective surgical or interventional procedures for all COVID-19 positive patients pending clearance of infection, which to date has been confirmed by repeat negative testing, unless a potential for harm would be incurred in procedural delay. For patients for whom urgent or emergency surgical or interventional procedures are required, COVID-19 testing is performed, when possible, before proceeding. If test results are available, level of PPE used and operating room protocols proceed according to testing results.

For patients with available negative COVID-19 testing, standard PPE is used. For patients with positive COVID-19 testing and for whom procedural deferral pending COVID-19 testing would incur perceived harm, procedures occur with full PPE and with additional

airborne precautionary measures using N95 respirator masking. If test results are unavailable for these patients, procedures proceed as if test results were positive, using full PPE. At our health system, there have been no PPE supply constraints interfering with following these algorithms.

Using data collected from a population of patients scheduled during the study period for upcoming surgeries/procedures at our medical center, we determined the proportion of asymptomatic patients with COVID-19 infection. Data for the analysis were derived from UCLA's Institutional Review Board-approved COVID-19 Task Force Research Registry of Suspected and Confirmed Cases of COVID within the UCLA Health System (IRB#20-000534). We designed and built COVID-19 RT-PCR test orders in our electronic health record with associated indication boxes. For purposes of testing asymptomatic patients awaiting surgeries and procedures, the COVID-19 RT-PCR order has an indication box of "pre-procedure." All COVID-19 RT-PCR test results accompanied by an indication of "pre-procedure" ordered between the dates of April 7, 2020 and May 21, 2020 were extracted from an existing data warehouse derived from the electronic health record. COVID 19 RT-PCR is performed at the UCLA Clinical Microbiology Laboratory on the Food and Drug Administration Emergency Use Authorization-approved Thermo TaqPath COVID 19 Combo Kit (ThermoFisher Scientific, Waltham, MA).¹⁸ This test has 3 viral gene targets (Orf1ab, S, N). Two of 3 targets must be present for a report of a positive (detected) result. If only 1 of 3 gene targets is present, the result is reported as inconclusive. A result of indeterminate indicates that the internal control against which the test is compared failed. Previous analysis for this testing at our health system demonstrates a clinical sensitivity of 98.3%, a specificity of 99%, and a negative predictive value of 99.99% (personal communication: Omai Garner, PhD, D). The test value results are characterized as "detected," "not detected," "inconclusive," and "indeterminate." Detected is equivalent to positive and not detected, negative, for SARS-CoV-2. Lab results are more broadly reported as abnormal (detected/positive or inconclusive) or normal (not detected/negative). For inclusion in our data set, orders were successfully completed and resulted at our medical center except on a rare occasion when a test was performed at an outside preapproved lab.

A chart review was performed for any patient with abnormal test results to confirm their symptom status at the time of COVID-19 pre-operative or pre-procedure testing. The data set was summarized at the patient level. Some patients had more than one "pre-procedure" COVID-19 test performed for a variety of reasons (rescheduled case dates, etc). If any of these results was abnormal, only one entry was used in the numerator to calculate prevalence of patients having had abnormal tests. The denominator was discrete patient numbers having had pre-procedure testing performed. Patient-level characteristics including age, race, and residential zip code were similarly extracted and joined to the aforementioned data set. The distance in miles between the center of each subject's residential zip code and our medical center zip code was used as an approximation of the patient's residential distance from the hospital and was calculated using the ZipRadius R package (R Foundation for Statistical Computing, Vienna, Austria). We compared our pre-operative and pre-procedure patient population demographics with those of Los Angeles (LA) County.¹⁹

Results

Of UCLA Health patients scheduled for upcoming surgeries or interventional procedures, 4,751 underwent protocol surveillance pre-operative/pre-procedure COVID-19 RT-PCR testing during the study period. Ninety percent of patients' residential addresses were within a 67-mile radius of our medical center. The remaining 10%

traveled to UCLA from outlying areas such as Bakersfield, Las Vegas, San Diego County, and beyond; the furthest distance recorded was 2,594 miles. Age demographics for patients tested under this protocol are shown in Fig 2 with comparative LA County population demographics.¹⁹ Test group race and ethnicity demographics with comparative LA County population demographics are presented in Table 1.¹⁹ There was equal male/female patient distribution. A review of 6 months of data for surgeries performed before initiating our surveillance preprocedure COVID-19 RT-PCR testing confirms an overall similar demographic.

Testing results are displayed in Fig 3. During the study period, 18 patients' (18/4,751, 0.38%) tests results were abnormal (positive or inconclusive). Ten of the 18 patients were confirmed to be asymptomatic within the 6 weeks before and at the time of pre-procedure surveillance COVID-19 testing, while 8 patients were noted to have symptoms consistent with or to have been recently diagnosed with COVID-19 infection. For purposes of our analysis, we excluded these 8 patients from the group characterized as asymptomatic, leaving 4,743 asymptomatic patients. Four asymptomatic patients had inconclusive (abnormal) test results. For purposes of our analysis, inconclusive results were excluded. The remaining 6 asymptomatic patients had results of detected/positive (6/4,739, 0.13%).

Surgeries and procedures scheduled for these 18 patients ranged in nature from orthopedic surgeries/procedures, gastroenterological endoscopies, interventional cardiac or vascular procedures or biopsies, trabeculectomy, dilatation and curettage (D & C), adrenal surgery, mastectomy, and others. Of the 10 asymptomatic and 8 symptomatic patients, 2 procedures (1 in each group, including one trabeculectomy and one D & C) were deemed urgent and proceeded despite positive surveillance preprocedure testing. These procedures were performed with the use of additional perioperative precautionary measures and use of the highest level PPE. The procedures proceeded without any known patient-related perioperative complications. To our knowledge, no HCW exposure to any of the COVID-19-positive patients tested by our protocol resulted in COVID-19 infection. Surgeries/procedures for the remaining patients with abnormal test results either proceeded after repeat negative COVID-19 testing or remained deferred owing to patient preference. All confirmed cancer-related procedures or surgeries proceeded, though 2 patients awaiting biopsies/mass excisions were rescheduled by 1 month pending repeat testing for viral clearance.

Two patients with positive/detected COVID-19 testing results had residential addresses in Las Vegas, NV. The remaining patients with positive results had residential addresses within a 10-mile radius of our medical center. Table II demonstrates demographic analysis of the 18 patients with abnormal test results. For the asymptomatic patients, we found similar race/ethnicity characteristics, male/female distribution, and age characteristics as compared with the overall tested population. For symptomatic patients, the numbers of patients were too small to comment about trends in race/ethnicity or male/female distribution, though there was a trend toward younger age, with 7/8 patients being under age 60.

Discussion

At the time of this publication, 201,106 Los Angelenos have tested positive for COVID-19, and 4,869 have died (2.4%).²⁰ Our medical center data demonstrate very low levels (0.13% prevalence) of COVID-19 positivity in asymptomatic patients scheduled for elective surgeries/procedures. While patients tested by this protocol are asymptomatic at the time of surgical scheduling, it is not possible to predict whether any patient may develop symptoms during the interval between procedural scheduling and pre-

Age Distributions of Pre-op/Pre-Procedure Tested and LA County Populations

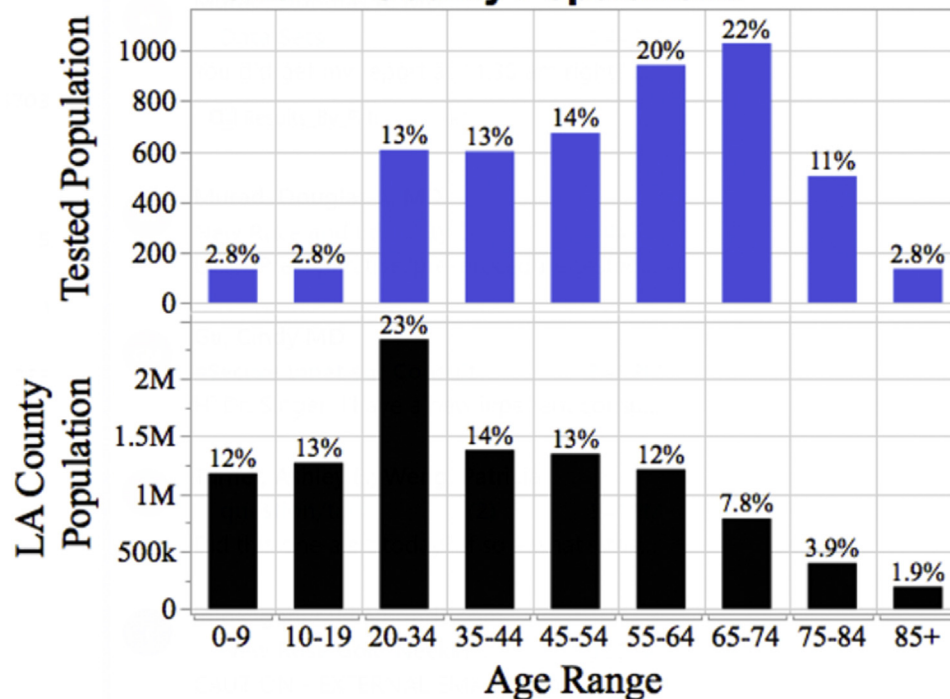


Fig 2. Age distributions of test population and LA County population (data for LA County demographics obtained from 2018 United States Census Bureau at data.census.gov¹⁹).

procedure COVID-19 RT-PCR surveillance testing. Some patients may have developed symptoms consistent with COVID-19, and others may have been diagnosed with COVID-19 infection while awaiting testing. We believe this accounts for the 8 symptomatic patients in our study population.

As a large urban referral center, we adopted the CDC and ACS recommendations early in the pandemic, suspending elective surgical and interventional procedures and later relaxing those suspensions while balancing local/regional COVID-19 epidemiology, data regarding our pre-operative/pre-procedure testing results, and health system resources and priorities. Our protocols designed to address COVID-19-related disruptions to surgery and procedure performance have guided an approach to prioritizing and safely performing surgical and interventional procedures, balancing the needs of the patient, HCW safety, and PPE supplies. Before all surgical/procedural patients were tested, our protocols for reducing

exposures in the operating room included a 20-minute time out after any intubation to allow clearance of potentially aerosolized viral particles before the entire team entered the operating theater for procedure start and the use of additional perioperative and airborne precautionary measures. Information about the very low level of COVID-19 infection in asymptomatic pre-operative/pre-procedure patients, using our COVID-19 RT-PCR testing with high clinical sensitivity, specificity, and negative predictive value, has provided reassurance to our surgeons, proceduralists, and anesthesiologists and has led to protocol modifications. Given the accuracy of our testing, our HCWs are reassured that using standard PPE should provide adequate protection during interactions with patients who have tested negative. Further, for patients with negative surveillance testing, the 20-minute, postintubation time out has been lifted, and universal donning of N95 respirator masks has been relaxed. At our health system, we continue to require

Table 1

Demographics among UCLA pre-operative/pre-procedure tested ($n = 4,751$) and LA County ($n = 10,105,518$) populations. (data for LA County Demographics obtained from 2018 United States Census Bureau at data.census.gov¹⁹)

| | UCLA Pre-operative/pre-procedure tested population, n (%) | LA County population, ¹⁹ (%) |
|---|---|---|
| Race | Person count n (%) | LA county population (%) |
| White | 3,059 (64.4%) | (51.3%) |
| Other | 993 (20.9%) | (21.3%) |
| Asian | 385 (8.1%) | (14.8%) |
| Black or African American | 280 (5.9%) | (8.0%) |
| More than one race | 21 (0.4%) | (4.3%) |
| Native Hawaiian or other Pacific Islander | 13 (0.3%) | (0.3%) |
| Ethnicity | Person count n (%) | LA county population (%) |
| Not Hispanic or Latino | 3,698 (77.8%) | (51.4%) |
| Hispanic or Latino | 730 (15.4%) | (48.6%) |
| Other | 323 (6.8%) | - |

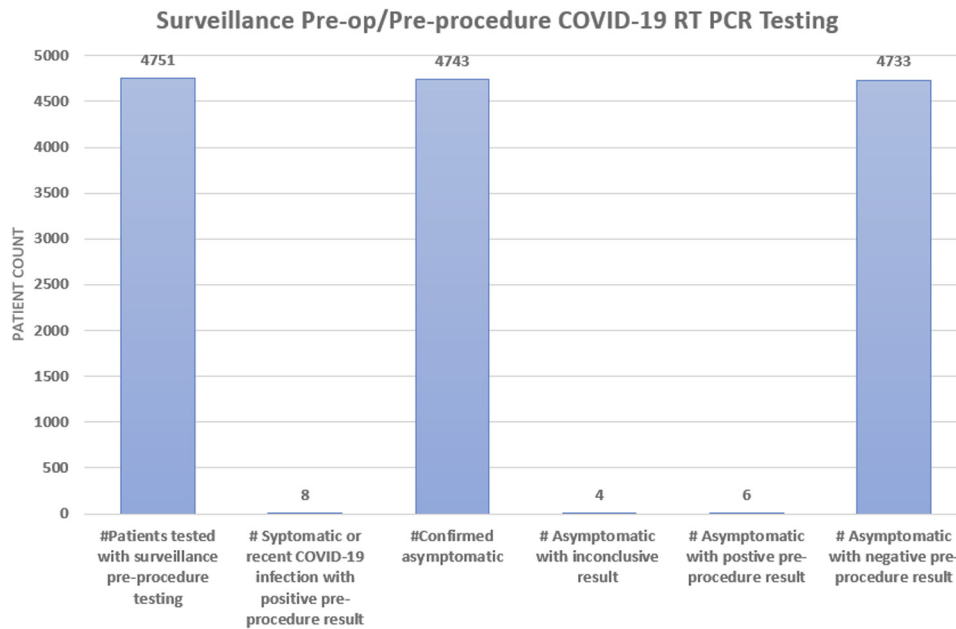


Fig 3. Surveillance pre-operative/pre-procedure COVID-19 RT-PCR testing.

universal masking of all HCWs, patients, and visitors older than 2 years of age.

One possible interpretation of our data is that there may be very low levels of COVID-19 infection in those who do not express COVID-like symptoms. Evidence suggests that between 5% and 75% of patients diagnosed with COVID-19 may be asymptomatic⁴; however, the prevalence of COVID-19 infection in asymptomatic patients is unknown. In interpreting our data, one must consider our catchment population. Patients awaiting surgeries and procedures at our health system may inherently represent a population at lower risk of COVID-19 infection. This patient population likely includes fewer in nursing homes and communal living facilities, where the known prevalence of COVID-19 is higher. Patients awaiting procedures may also practice stricter social distancing to avoid COVID-19 exposures that could interfere with their planned

procedures. There may be additional inherent differences as regards health insurance coverage and proportion of tertiary/quaternary patients at our medical center compared with higher risk populations. Taken together, these factors could lower the prevalence of disease in our studied population, which represents a sample of the overall LA area demographic

When comparing our surgical/procedural population to LA County data, there are clear differences with more Whites, older patients, and fewer Hispanics/Latinos in our data set as compared with the greater LA area population. As highlighted in Fig 2, our sample population of patients scheduled for upcoming surgeries and procedures represents an overall older population as compared with the greater LA area population demographics. We did see a trend toward younger age for our symptomatic, or recently diagnosed COVID-19 positive, patients, more commensurate with overall LA population demographic data. While the number of patients in this category was too low to determine statistical significance of this trend, we hypothesize that the younger cohort may exercise less strict social distancing, may be more active critical workforce members, and may more likely act as care givers, activities potentially contributing to an increased exposure/infection risk when compared with the overall cohort.

As emerging evidence suggests that the prevalence and severity of COVID-19 disease presentations are greater in Blacks and Hispanics, one might conclude that our data do not equally represent populations with baseline higher prevalence of disease.²¹⁻²³ Though the numbers of patients with abnormal testing in our dataset are too small to calculate statistical significance, we did not see trends toward higher prevalence of asymptomatic or symptomatic disease in under-represented populations as compared with our overall population. The overall very low numbers of COVID-19 positive patients in our data set preclude the ability to extrapolate significance of this finding.

Our data do not address the proportion of the regional population that has been exposed and is now immune. Recent data suggest a possible seroprevalence of antibodies to SARS-CoV-2 of 4.65% in LA County.²⁴ In that data set, 13% of those tested for antibody to SARS-CoV-2 reported fever with cough, 9% fever with shortness of breath, and 6% loss of smell or taste, suggesting that a

Table II Demographics among 18 patients with abnormal (positive or inconclusive) testing

| | Asymptomatic patients (n = 10) | | Symptomatic or recent COVID-19 positive patients (n = 8) | |
|------------------------|--------------------------------|--------|--|--------|
| | Mean | Median | Mean | Median |
| Age (y) | 54.7 | 62.5 | 42.3 | 44.0 |
| Sex | Person count n, (%) | | Person count n, (%) | |
| Male | 6 (60.0%) | | 3 (37.5%) | |
| Female | 4 (40.0%) | | 5 (62.5%) | |
| Race | Person count n, (%) | | Person count n, (%) | |
| White | 8 (80.0%) | | 3 (37.5%) | |
| Black | 1 (10.0%) | | 1 (12.5%) | |
| Asian | 0 (0.0%) | | 1 (12.5%) | |
| Other | 1 (10.0%) | | 2 (25.0%) | |
| Unavailable | 0 (0.0%) | | 1 (12.5%) | |
| Ethnicity | Person count n, (%) | | Person count n, (%) | |
| Not Hispanic or Latino | 8 (80.0%) | | 5 (62.5%) | |
| Hispanic or Latino | 2 (20.0%) | | 2 (25.0%) | |
| Unavailable | 0 (0.0%) | | 1 (12.5%) | |

proportion of those tested may have been symptomatic for COVID-19 at the time of testing. According to Spellberg et al the prevalence of COVID-19 infection in patients with mild flu-like illness treated at another large academic medical center in LA (LA County-USC) was 5%.²⁵ They excluded patients with known COVID-19 exposures, recent travel, or severe symptoms but included only patients endorsing mild flu-like symptoms. Our data, demonstrating a 0.13% prevalence of asymptomatic COVID-19 infection, may be explained by the nature of our testing a population of patients presumed to be asymptomatic and awaiting scheduled surgeries/procedures.

Conclusions

In conclusion, using a surveillance preprocedure COVID-19 RT-PCR test with high clinical sensitivity, specificity, and negative predictive value, we found very low levels (0.13% prevalence) of COVID-19 infection in asymptomatic patients undergoing scheduled surgeries/procedures at UCLA Health. Comparing data obtained by similar analyses from other asymptomatic populations would be required before determining scalability of our findings or applying this asymptomatic prevalence data to wider populations.

As the scientific community gains further understanding of the pathophysiology of SARS-CoV-2, we continue to evaluate our testing protocols in line with CDC and ACS guidance, with plans to adjust as appropriate based on evolving epidemiologic awareness of the COVID-19 infection. Given that there is no currently available confirmatory data about how much exposure to known COVID-19 infection, or about level of risk that asymptomatic/presymptomatic infection may confer toward disease transmission, we believe that our algorithms supporting use of full PPE for patients positive for COVID-19 or for those with unknown COVID-19 status, with relaxed PPE use when patients have tested negative, maximize safe practices for patients and HCWs while optimizing an appropriate use of scarce PPE resources. Our data have helped to inform perioperative protocols for surgical and procedural cases and have provided reassurance to surgeons, anesthesiologists, and HCWs as they begin to increase delivery of important health care services during the global COVID-19 pandemic. Testing protocols like ours may prove valuable as a guide for other health systems in individualizing their plans for safe procedural practices during COVID-19.

Conflict of interest/Disclosure

No author on this manuscript has any conflict of interest or competing interest to disclose.

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